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TC 1700

REMARKS

Support for the language of new claims 5-37 is found throughout the specification and drawings.

It is submitted that all claims are now of proper form and scope for allowance.

Early and favorable consideration is respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Respectfully submitted,

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IN THE CLAIMS:

Please CANCEL all claims 1-4 and substitute NEW claims 5-37, as follows:

5. (NEW) A spot joining device comprising:

a joining tool having a pin at a tip end portion thereof, the pin being protruded along an axis of the joining tool;

a rotation motor for rotating the joining tool around the axis thereof; and

a motion motor for moving the joining tool along the axis thereof, wherein

the joining tool is moved along the axis by the motion motor while the joining tool is rotated by the rotation motor,

the pin is pressed against a predetermined joint spot of lapped works to be joined and inserted into the predetermined joint spot heated and softened due to friction heat,

portions of the lapped works that are in the vicinity of the predetermined joint spot are agitated by using the rotating pin, thereby leading to the lapped works being fused at the predetermined joint spot,

the joining tool is then pulled out along the axis by the motion motor, whereby

the lapped works are spot-joined at the predetermined joint spot.

6. (NEW) The spot joining device according to Claim 5, wherein the motion motor is a servo motor.

7. (NEW) The spot joining device according to Claim 5, wherein the rotation motor is an induction motor.

8. (NEW) The spot joining device according to Claim 5, wherein the rotation motor is a servo motor.

9. (NEW) The spot joining device according to Claim 5, comprising:

a frame on which the motion motor is provided; and

a linear guide mounted on the frame for guiding the joining tool movably along the axis of the joining tool.

10. (NEW) The spot joining device according to Claim 9, wherein the linear guide comprises:

a guide rail extending in parallel with the axis of the joining tool; and

a guide member movably attached to the guide rail and rotatably supporting the joining tool.

11. (NEW) The spot joining device according to Claim 10, wherein a ball screw is mounted on the frame, the ball screw comprising:

a screw shaft mounted on the frame and driven by the motion motor to rotate; and

a nut mounted on the guide member and screwed on the screw shaft.

12. (NEW) The spot joining device according to Claim 10, wherein the rotation motor is provided on the guide member.

13. (NEW) The spot joining device according to Claim 5, further comprising a receiving member disposed opposite to a tip end portion of the joining tool, the receiving member having a flat receiving face on which the lapped works to be joined are placed and receiving a pressing force from the joining tool pushing against the lapped works.

14. (New) The spot joining device according to Claim 13, wherein the receiving member is a column-shaped member placed opposite to the joining tool and disposed coaxially with the axis of the joining tool.

15. (NEW) The spot joining device according to Claim 13, wherein the frame is bent in L-shape and has a tip end portion to which the receiving member is mounted.

16. (NEW) The spot joining device according to Claim 5, wherein the spot joining device is a spot gun worn on a wrist of an articulated robot.

17. (NEW) The spot joining device according to Claim 5, wherein the spot joining device is a spot gun which is movably carried by an operator to perform spot joining operation therewith.

18. (NEW) A spot joining method comprising the steps of:

rotating a joining tool having a pin at a tip end portion thereof around an axis of the joining tool with the pin pressed against a predetermined joint spot of lapped works to be joined, the pin being protruded along the axis;

inserting the pin into the predetermined joint spot of the lapped works heated and softened due to friction heat;

agitating portions of the lapped works that are in the vicinity of the predetermined joint spot by using the rotating pin, thereby leading to the lapped works being fused at the predetermined joint spot, and

pulling out the joining tool along the axis, thereby performing spot joining of the lapped works at the predetermined joint spot.

19. (NEW) The spot joining method according to Claim 18, wherein a receiving member is disposed opposite to a tip end portion of the joining tool, the receiving member having a flat receiving face on which the lapped works to be joined are placed and receiving a pressing force from the joining tool pushing against the lapped works.

20. (NEW) A spot joining method for spot-joining lapped works by using the spot joining device according to in Claim 5.

21. (NEW) The spot joining method according to Claim 18, wherein the lapped works are comprised of two or more works.

22. (NEW) The spot joining method according to Claim 18, wherein the lapped works are a plurality of flat-plate shaped or three-dimensionally shaped works having lapped faces to be spot-joined.

23. (NEW) The spot joining method according to Claim 18, wherein the lapped works are works made of metal, words made of synthetic resin, or works in which decorative sheets made of synthetic resin are bonded to outer faces of metal plates.

24. (NEW) The spot joining method according to Claim 18, wherein the lapped works are outer plates of an automobile.

25. (NEW) The spot joining method according to Claim 18, wherein the lapped works are outer plates of a railway vehicle.

26. (NEW) An outer plate of an automobile manufactured by a method for spot-joining lapped works at a joint spot, the method comprising the steps of:

rotating a joining tool having a pin which is protruded along the axis at a tip end portion thereof around an axis of a joining too with the pin pressed against a predetermined joint spot of lapped works to be joined which constitute an outer plate of an automobile,

inserting the pin into the predetermined joint spot of the lapped works heated and softened due to friction heat,

agitating portions of the lapped works that are in the vicinity of the predetermined joint spot by using the rotating pin, thereby leading to the lapped works being fused at the predetermined joint spot, and

pulling out the joining tool along the axis, thereby performing spot-joining of the lapped works at the predetermined joint spot.

27. (NEW) A joining tool for spot-joining, wherein the joining tool having a pin which is protruded along the axis at a tip end portion thereof is rotated around an axis of the joining tool with the pin pressed against a predetermined joint spot of lapped works to be joined, the pin is inserted into the predetermined joint spot of the lapped works heated and softened due to friction heat, portions of the lapped works that are in the vicinity of the predetermined joint spot are agitated by the rotating pin, the lapped works are fused at the predetermined joint spot, thereby the spot joining is performed, and

a tip end portion of the pin has a raised central portion thereof.

28. (NEW) The joining tool for spot-joining according to Claim 27, comprising a short-column shaped shoulder portion, wherein the pin is coaxially protruded from an end face of the shoulder portion, and the end face is inverted-conical shaped such that it is inwardly recessed in the axial direction of the shoulder portion.

29. (NEW) The joining tool for spot joining according to Claim 27, wherein a corner portion where the end face and the pin are connected is smooth and circular-arc shaped.

30. (NEW) The joining tool for spot joining according to Claim 27, comprising a short-column shaped shoulder, wherein the pin in coaxially protruded from an end face of the shoulder portion, and the end face is a flat face perpendicular to the axis.

31. (NEW) The joining tool for spot joining according to Claim 30, wherein the end face and the pin form a right angle.

32. (NEW) The joining tool for spot joining according to Claim 28, wherein a corner portion where an outer peripheral face of the shoulder portion and the end face are connected is smooth and circular-arc shaped.

33. (NEW) A joining tool for spot joining, wherein a joining tool having a pin which is protruded along the axis at a tip end portion thereof is rotated around an axis of the joining tool with the pin pressed against a predetermined joint spot of lapped works to be joined, the pin is inserted into the predetermined joint spot of the lapped works heated and softened due to friction heat, portions of the lapped works that are in the vicinity of the predetermined joint spot are agitated by using the rotating pin, the lapped works are fused at the predetermined joint spot, thereby the spot-joining is performed,

a tip end portion of the pin has a raised central portion thereof, and the pin is coaxially protruded from an end face of a short-column shaped shoulder.

34. (NEW) The joining tool for spot-joining according to Claim 27, wherein a basic end portion of the shoulder portion is connected to a tip end of the joining tool which is conically tapered toward the tip end.

35. (NEW) The joining tool for spot joining according to Claim 33, comprising a short-column shaped shoulder, wherein the pin is coaxially protruded from an end face of the shoulder portion, and the end face is a flat face perpendicular to the axis.

36. (NEW) The joining tool for spot joining according to Claim 27, wherein a screw is formed at a tip end of the pin.

37. (NEW) The joining tool for spot joining according to Claim 33, wherein a screw is formed at a tip end of the pin.